INSTRUCTION MANUAL

Simrad HS50
Heading Sensor



[AF]

[20221081]

Note!

Simrad AS makes every effort to ensure that the information contained within this document is correct. However, our equipment is continuously being improved and updated, so we cannot assume liability for any errors which may occur.

Warning!

The equipment to which this manual applies must only be used for the purpose for which it was designed. Improper use or maintenance may cause damage to the equipment or injury to personnel. The user must be familiar with the contents of the appropriate manuals before attempting to operate or work on the equipment.

Simrad AS disclaims any responsibility for damage or injury caused by improper installation, use or maintenance of the equipment.

Instruction Manual
HS50 Heading Sensor

This manual is intended as a reference guide for installing, operating and maintaining Simrad HS50 Heading Sensor.

Document revisions

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Document history

Rev. A	Original issue.
Rev. B	The manual updated and rewritten.
Rev. C	Cable pair numbers for Sensor unit corrected (page 13). Optional documentation for additional languages added.
Rev. D	Updated to correspond with PU sw version 2.02.03 and DU sw version 1.02.
Rev. E	Updated to correspond with PU sw version 2.02.04, DU sw version 1.03. and SU sw version 1.02 . Dim. drawing for Sensor unit updated to show mounting direction.
Rev.F	Corrected part number for HS50 Display unit mounting bracket (page 16).

To assist us in making improvements to this manual, we would welcome comments and constructive criticism. Please send all such - in writing to:

Simrad Egersund AS
Nyåskaien
P.O. Box 55
N-4379 Egersund, Norway

or by e-mail to:
simrad.documentation@simrad.com

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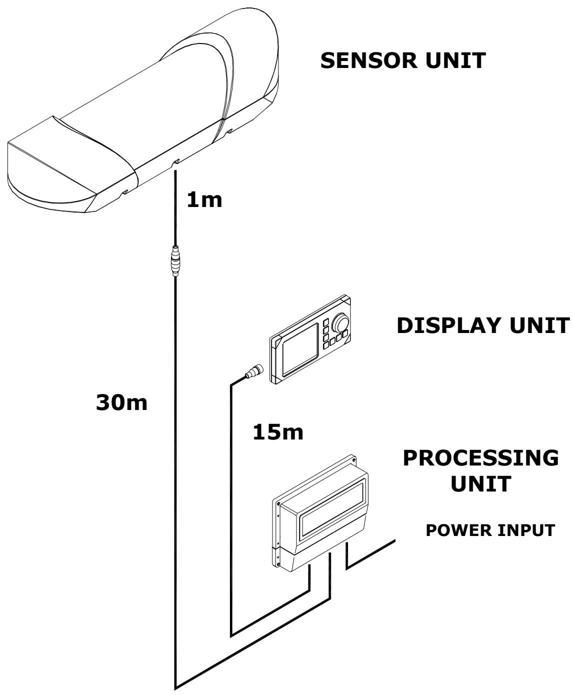
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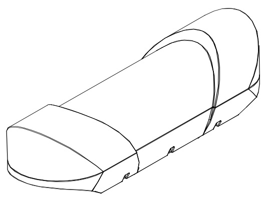
1. INTRODUCTION

1.1 HS50 System components

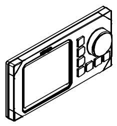
Simrad HS50 is a GPS compass that provides true heading output with position, velocity and rate of turn information in addition. This product replaces several vessel instruments with one compact navigation package: gyrocompass, GPS system, speed log and Rate Of Turn (ROT) indicator.

The HS50 comprises the following units:

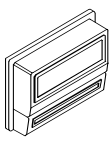




The Sensor unit contains two GPS sensors, electronic board with I/O and an inertial rate element.
The Sensor unit is to be mounted in the vessel's mast or flat on a roof or deck.



The Display unit contains an LCD for navigation information, mainboard with CPU, flash, power and I/O, and buttons for setup and operation of the HS50 system.



The Processing unit contains the mainboard with CPU, flash, power, I/O and a terminal list.

High-precision heading is derived from the fixed-distance dual GPS antenna arrangement in the Sensor unit, using carrier phase data to generate heading information independent of latitude and vessel dynamics. GPS position and speed are calculated from both antennas, which give redundant position and velocity sources in this product. DGPS signals may be input to the HS50 to improve position and velocity accuracy, but has no impact on the heading accuracy. Refer ***Performance data***, page 6.

The inertial rate element provides yaw/ROT information. In case of short GPS outages, the inertial sensor automatically takes over as the prime source for heading determination until the GPS comes back on line. Working together seamlessly, the inertial and GPS elements of the system insure accurate, continuous and robust heading information.

The Processing unit includes configurable output serial lines (three RS-232 and three RS-422) and Ethernet connections making it easy to distribute HS50 data to multiple users on board the vessel.

The HS50 requires no scheduled maintenance or re-calibration. The system offers flexible configuration of the output variables and interface setup, depending on the vessel and application. It is easy to operate, install and align.

The HS50 system has the following features:

- True heading anywhere on earth
- Replaces several instruments with one robust, integrated product
- Heading available in periods of GPS drop-outs
- 20 Hz update rate on heading and rate of turn measurements
- 80°/sec follow-up rate
- Three RS-232 and three RS-422 configurable output serial lines
- Output data on Ethernet
- Only one cable (no coax) between the mast unit and the Processing unit on the bridge

1.2 About this manual

This manual is intended as a reference guide for operating, installing and maintaining the HS50 Heading Sensor. Please take time to read this manual to get thorough understanding of the operation and system components.

In this manual the following notations are used:

Caution! ***Used to make the user aware of procedures and operational practice which, if not followed, may result in degraded performance or damage to the equipment.***

Note! *Used to draw the user's attention to special features or behavior of the equipment.*

1.3 Definitions, abbreviations and acronyms

Definitions

Alignment The process of adjusting the current internal navigation frame (sensor-frame) in the instrument to the true vessel body frame.

Heading The direction of the main axis (bow direction) of the vessel. This is opposed to course, which is the direction of the vessel motion.

Yaw A rotation about the vertical axis and is positive when turning eastward when the vehicle cruises in north direction. Normally yaw means the dynamic yaw motion.

Abbreviations and acronyms

CEP	Circular Error Probability
COG	Course Over Ground
DGPS	Differential GPS
DU	HS50 Display Unit
EPE	Estimated Position Error
GPS	Global Positioning System
GSA	A standard NMEA message including GPS satellite ID numbers, PDOP, HDOP and VDOP
HDOP	Horizontal Dilution Of Precision
HGT	GPS Antenna Height above the WGS-84 ellipsoid
IEC	International Electrotechnical Commission
IMO	International Maritime Organization
I/O	Input/Output
NMEA	National Marine Electronics Association. NMEA 0183 is a standard for interchange of information between navigation equipment
PDOP	Positional Dilution Of Precision. This is the sum of the VDOP and HDOP figure
PSXN20	A proprietary NMEA message including position, height and heading quality information
PU	HS50 Processing Unit
RFI	Radio Frequency Interference
RF	Radio Frequency
RMS	Root Mean Square
ROT	Rate of Turn
RRE	Range Residual Error, a proprietary format
RTCM	Radio Technical Commission of Maritime Services
SOG	Speed over Ground
SSB	Single Side Band
UTC	Universal Time Co-ordinate. This is the official time in the world and has replaced GMT (Greenwich Mean Time) as the official time
VDOP	Vertical Dilution Of Precision
VHF	Very High Frequency
WGS-84	World Geodetic System of 1984

2. TECHNICAL SPECIFICATIONS

2.1 Health, environment and safety

Operation or troubleshooting of HS50 equipment will not imply any risk for high voltages, explosions or exposure to gas. The HS50 is type-approved according to IEC 950/EN60950 standards regarding product safety (low voltage), and IEC 945/EN60945 standards on electromagnetic compatibility (immunity/radiation) and vibration.

2.2 Restrictions in guarantee

The liability of the manufacturer is limited to repair of the HS50 only, and excludes consequential damages such as customer's loss of profit or damage to other systems traceable back to HS50 malfunction. The warranty does not cover malfunctions of the HS50 resulting from the following conditions:

a) The customer has opened the Sensor unit

b) Over-voltage or incorrect power connection

c) The equipment has been exposed to extreme chock and vibrations

2.3 Restrictions in use

Simrad HS50 is designed for use on board marine surface operated vessels with roll and pitch motions up to ±30°.

The HS50 function is based on GPS signals and requires free sight to the sky, minimum 4 visible satellites, PDOP value less than 6 and otherwise normal conditions to operate.

2.4 Performance data

Heading accuracy, static: .... 0.3° RMS

Heading accuracy, dynamic: .... 0.5° RMS

Heading resolution: .... 0.01°

Heading operational measurement range: .Roll/pitch within ±30°

Rate of turn accuracy: .... 0.5°/s + 5%

Position accuracy: .... 5 m 95% CEP

Velocity accuracy: .... 0.1 m/s 95% CEP

Follow-up rate: .... 80°/sec

The performance figures are valid with a minimum of 4 visible satellites, HDOP less than 4, PDOP value less than 6, high quality DGPS corrections * and otherwise normal conditions. Excessive multipath, GPS signal obstructions or interference may reduce the performance.

The HS50 Sensor unit includes two 12 channels GPS receivers.

* Has no impact on heading accuracy.

2.5 Physical dimensions

Sensor unit

Width .... 850 mm (33.5 in.)

Height: .... 205 mm (8.1 in.)

Depth: .... 262 mm (10.3 in.)

Weight: .... 8 kg (17.6 lbs.)

Color: .... White

Dimensional drawing .... Page 50

Display unit

Width: .... 220 mm (8.7 in.)

Height: .... 110 mm (4.3 in.)

Depth: .... 39 mm (1.5 in.)

Weight: .... 0.5 kg (1.1 lbs.)

Color: .... Black

Dimensional drawing .... Page 54

Processing unit

Width: ....287 mm (11.3 in.)

Height: ....203 mm (8 in.)

Depth: ....60 mm (2.4 in.)

Weight: .... 1.3 kg (2.9 lbs.)

Color: .... Black

Dimensional drawing...Page 53

2.6 Power

Processing unit

Voltage:.. 10 to 36 V DC

Power consumption: ....15 W

2.7 Environmental specification

Sensor unit

Enclosure material, sensor housing: ....Polyethylene

Enclosure material bracket: ....Anodized aluminum

Enclosure protection:..IP65

Operating temperature range: .... -30 to +55ºC (-22 to 131°F)

Operating humidity (max.): 100%

Storage temperature range:............... -30 to +70ºC (-22 to 158°F)

Storage humidity (max.): 100%

Safe distance to compass: .... 0.2 m (0.7 ft)

Display unit

Enclosure protection:.............. IP-56 from front, IP-43 from back

Operating temperature range: ....0 to +55ºC (32 to 131°F)

Storage temperature range:............... -30 to +80ºC (-22 to 176°F)

Safe distance to compass: .... 0.35 m (1.1 ft.)

Processing unit

Enclosure material: .... Anodized aluminum

Enclosure protection: IP44

Operating temperature range: ....0 to +55ºC (32 to 131°F)

Storage temperature range: .... -20 to +60ºC (-4 to 140°F)

Safe distance to compass: .... 0.2 m (0.7 ft)

2.8 Cable

Processing unit to sensor unit cable

Type: ....2x2x0.5 mm^2 with shield

Maximum length: .... 100 m (328 ft)

Diameter: ....10 mm (0.4 in.)

Flame retardation: ....IEC 332-3/A

2.9 Interface

Configuration: .... Display unit connected to the Processing unit

Data outputs: ....Three RS-232 serial lines,
Three RS-422 serial lines,
Ethernet UDP/IP

Data inputs: .... One RS-232 and one RS-422 serial line

DGPS corrections: ..... RTCM 104 version 2.2 and SAPOS® EPS

Baud rate: ....Max. 38.4 kBaud

HDT, ROT, GGA and GLL data update rates: .... Up to 20 Hz

HDT, ROT, GGA and GLL data delay: ....Less than 50 ms

ZDA and VTG data update rate: ....Max 1 Hz

VTG data delay: .... Max 1.5 sec

ZDA data delay: .... 1 ms

Data output formats:

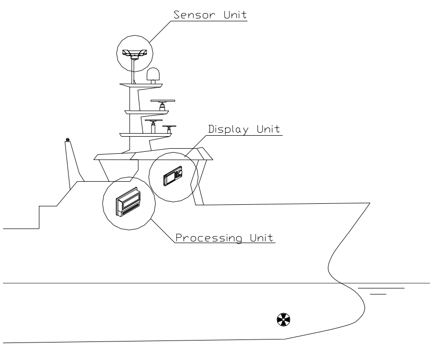
- NMEA 0183 ZDA, GGA, GLL, VTG, HDT, ROT, GSA, GRS and proprietary messages PSXN,20. The PSXN,20 message include position, height and heading quality information
- RD Instrument ADCP proprietary NMEA format, "PRDID".
- Radar clock data

3. INSTALLATION

3.1 General

The following parts are supplied with a standard HS50 system:

- Sensor unit with 1 meter cable w/connector and 4 fastening bolts
- Display unit with 15 meters cable to the Processing unit and flush mounting kit
- Processing unit including 4 fastening screws
- 30 meters cable to be used between Sensor unit and Processing unit
- Documentation



Caution!

The Sensor unit has to be mounted in a way that avoids blocking of the GPS signal.

The Processing and Display Unit can be mounted on the bridge or in the instrument room.

No units should be exposed to heavy vibration, transformers or similar.

3.2 Cable connection

Use only shielded cables for the installation. This includes power input and signal cables. The cables should be of 0.5 mm^2 (AWG20) twisted pairs.

The cable to the Display unit and other cables (NMEA input/output, Ethernet) should not be run in parallel with other cables carrying RF or high current, such as VHF and SSB transmitters, battery charges/generators and winches.

3.3 Grounding

All units in the HS50 system use the Processing unit as a common ground/shield connection. The Processing unit should therefore have a proper ground connection to the hull/bonding system.

3.4 Sensor unit

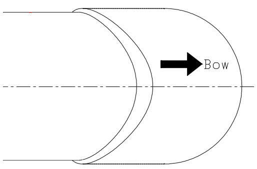
Location of the unit

The Sensor unit is the most important part of the HS50 system, and great care should be taken when deciding the mounting location.

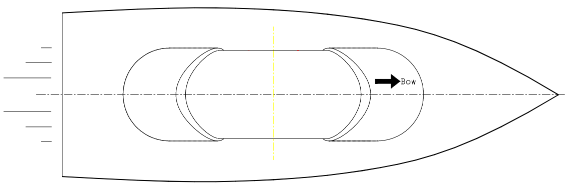
The space above the Sensor unit has to be free of obstructions of any kind. A GPS compass is more sensitive for blocking and reflections (multipath) of GPS signals than GPS sensors that are only used for calculating position. This since HS50 also utilizes carrier phase measurements for heading determination, and both GPS antennas need to see at least two common satellites at the same time.

The unit should be protected from direct illumination of radar beams and other transmitting antennas such as Inmarsat antennas.

The Sensor unit has to be mounted horizontally in the mast or directly on deck, with 5° maximum allowed deviation angle from the horizontal plane. If mounted in the mast, the distance from the unit to the nearest deck should be as large as possible to reduce problem due to the multipath effect.



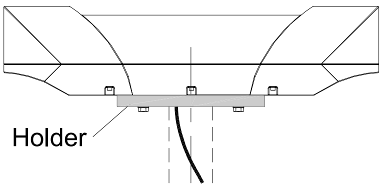
The unit should also be mounted parallel to the vessel's centerline with the bow arrow pointing forward. The heading offset feature will however compensate for a heading offset caused by the orientation of the Sensor unit. An eventual offset correction is performed after the calibration as described in ***Software setup procedure***, ***Heading offset***, page 31.



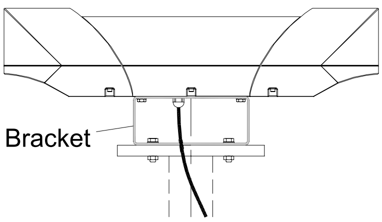
Mechanical installation

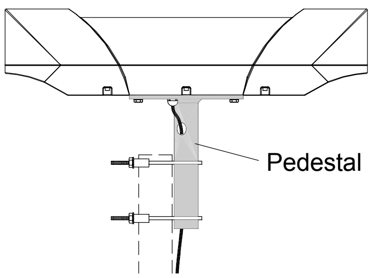
The Sensor unit may be mounted in the mast or directly on the deck.

The dimensional drawing for the Sensor unit on page 50 shows dimensions and internal distance for the mounting holes and the cable outlet.



If necessary, a user-made holder may be used as shown on the figure when installing the unit.

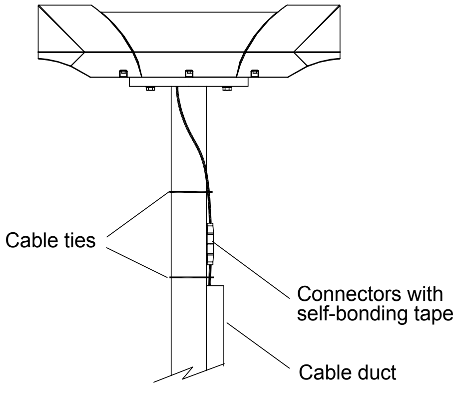




A mounting bracket (part no. 20213039) or a mounting pedestal (part no 20213021) can be delivered from Simrad by request. Dimensions for these optional mounting devices are shown on page 51 and page 52.

Refer ***Bracket mounting (option)***, page 12, and ***Pedestal mounting (option)***, page 13.

Caution! ***Independent on which fastening method that is used, the Sensor unit should not differ more than ±5° from the vessel's horizontal plane and the alongships axis. If the mounting is not within this tolerance, the heading accuracy will be degraded.***



Connect the cable from the Processing unit to the cable from the Sensor unit.

Caution!

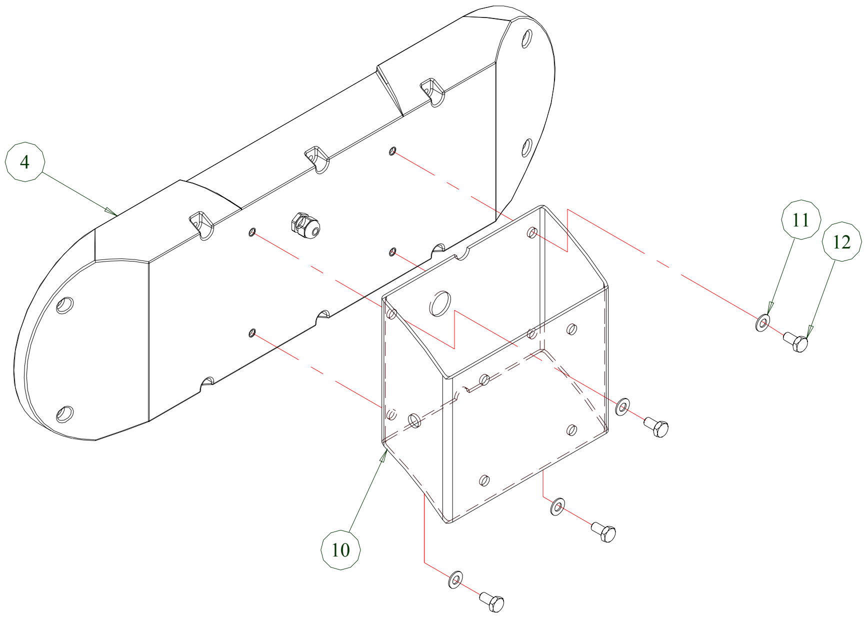
The connector junction must be sealed with self-bonding tape for waterproofing. After coiling, make bonding by hard pressure.

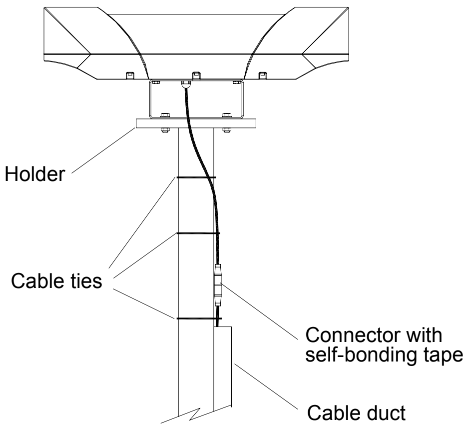
Use the required number of cable ties to fasten the cable to the mast.

Bracket mounting (option)

An optional mounting bracket (part no. 20213039) can be delivered from Simrad by request.

Assemble the mounting bracket to the Sensor unit with the four screws with washers as shown in the figure below.



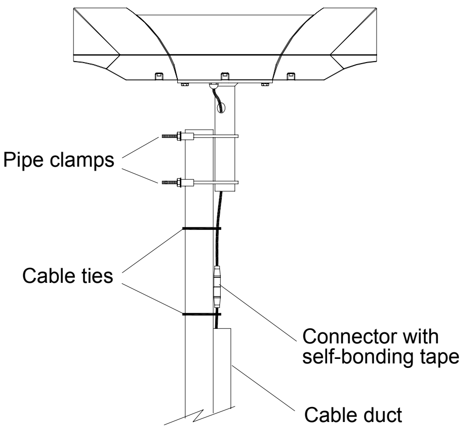


Connect the cable from the Processing unit to the cable as described in page 11.

Pedestal mounting (option)

An optional mounting pedestal (part no. 20213021) can be delivered from Simrad by request. This pedestal is designed for 2-inch mast mounting.

Attach the pedestal to the Sensor unit with the four screws and washers similar to the bracket mounting option described on page 12.



1 Lift the Sensor unit in the preferred direction on the mast. Use two pipe clamps with preferred size for mounting the Sensor unit pedestal to the mast top.

2 Ensure that the Sensor unit is mounted in such a way that torsion movement relative to the mast is kept at an absolute minimum.

All nuts should be secured with washers or by self-locking nuts.

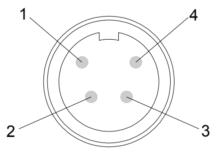
Connect the cable from the Processing unit to the cable as described in page 11.

Cable wiring

The wiring for the Sensor unit cable in the Processing unit terminals is as follows:

Cable Wire No.	Signal Description	Processing Unit Connector P201
		Label
Screen	Cable shield	GND
4	Transmit	COMM+
3	Receive	COMM-
2	+24 VDC	PWR+
1	Power ground	PWR-

If the Sensor unit connector needs to be reconnected to the cable, the wiring for the cable within the Sensor unit connector is as follows:

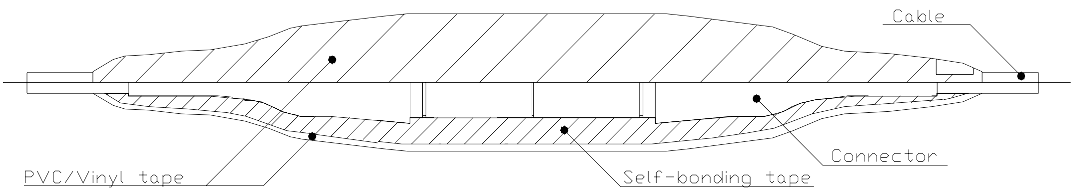
	Sensor Unit Connector	Cable Wire No.	Signal Description
	**Pin no.**		
	Connector housing	Screen	Shield
	2	4	Transmit
	4	3	Receive
FRONT VIEW	3	2	+24 VDC
	1	1	Power ground

Waterproofing the connectors

The Sensor unit connector junction has to be sealed with self-bonding tape and PVC/Vinyl tape for waterproofing.

1 Coil the self-bounding tape from one cable end to the other. Use at least two layers with tape. After coiling, make a bonding by pressure of fingers.

2 Coil at least two layers of PVC/Vinyl tape without stretching as shown in the figure below. After coiling, make a bonding by pressure of fingers.



3.5 Display unit

Location of the unit

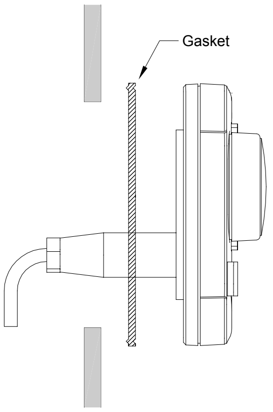
Avoid mounting the Display unit where it is easily exposed to sunlight, as this will shorten the lifetime of the display. If this is not possible, make sure the unit is always covered with the white protection cover when not used.

The unit is designed for installation in an indoor environment and for operation within the temperature range. The best location is typically in the instrument room or on the bridge mounted close to the Processing unit.

Panel mounting

Two mounting methods may be used when panel mounting the HS50 Display unit.

A drilling template, part no. 22084883, is supplied with the HS50 documentation. Use this template when making panel cut-out and drilling holes.



1 Remove the front panel corners.

2 Drill the mounting holes and make panel cut-out according to supplied template.

3 Use the supplied gasket (part no. 22084693) between the panel and the unit.

4 Fasten the Display unit to the panel with the supplied 19 mm screws.

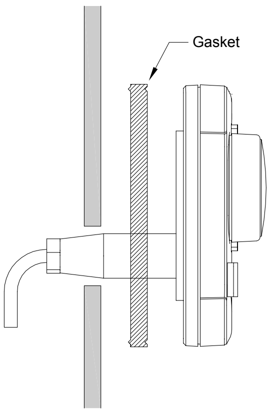
5 Apply the front panel corners.

6 Connect the Processing unit cable to the Display unit connector.

Caution! ***Do not over-tighten the mounting screws.***

Alternative panel mounting

This way of mounting is simpler, but will lift the unit from the panel surface. When installed adjacent to Simrad MarineLine equipment there will be a 5.5 mm (0,22") difference in height between the Display unit and other equipment.



1 Remove the front panel corners.

2 Use the template and drill hole(s) only for the connectors.

3 Place the 7.5 mm gasket (part no. 22086029) between panel and unit, correctly oriented (see marking on gasket).

4 Fasten the Display unit to the panel with the supplied 19 mm screws.

5 Apply the front panel corners.

6 Connect the Processing unit cable to the Display unit connector.

Bracket mounting (option)

An optional bracket, part no. 22084941, may be ordered from Simrad.

Note! *When the Display unit is bracket-mounted, it is not weatherproof from the back due to a breathing hole in the back cabinet. When bracket-mounted, the exposed parts of the plugs should be protected against salt corrosion.*

1 Locate the cradle on the mounting site and mark the 4 holes for the screws on the mounting surface.

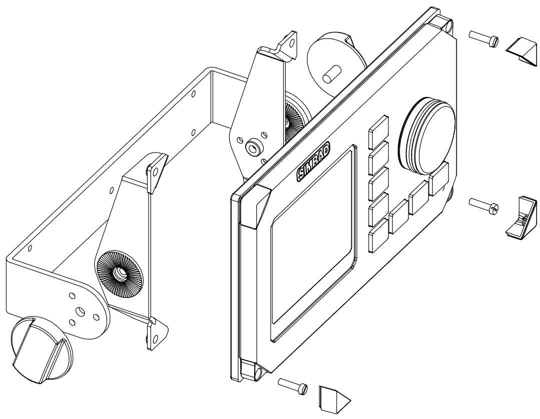
2 Drill the 4 holes and screw the cradle to the mounting surface.

3 Remove the front panel corners, and use the supplied screws to fasten the Display unit to the left and right brackets.

4 Apply the front panel corners.

5 Use the two locking knobs to assemble the cradle with the left and right brackets and adjust the Display unit for the best viewing angle.

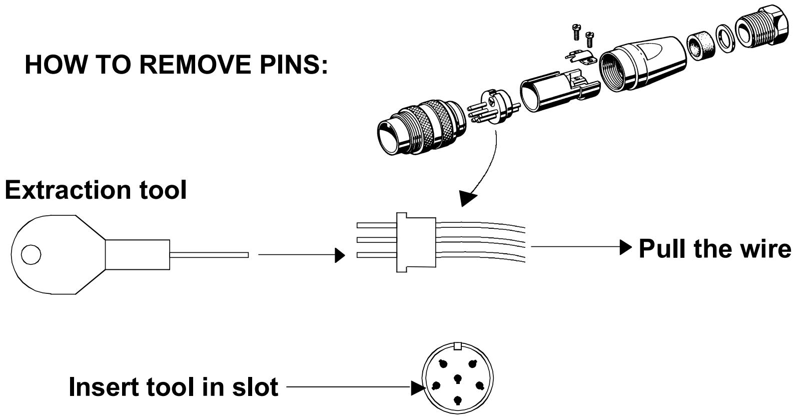
6 Connect the cable from the Processing unit to the Display unit connector.



Display unit cable

The 15 m cable to the Processing unit has connector only at the Display unit end. Optional extensions cable (10 m) is available and has a male and a female connector.

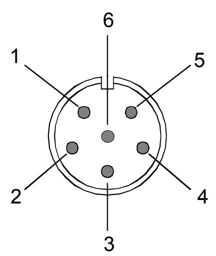
The connector is of crimp type. It can be easily disassembled, if desired for ease of installation. The extracting tool (p.no. 44161792) may be ordered from Simrad.



See the table below for pin configuration and color code for this cable. DO NOT MIX THE PINS AND THE CABLE COLORS!

Note! *Apply a thin layer of pure Vaseline on the connector threads and make sure the connectors are properly secured to the receptacle by the coupling ring. The connectors are weather proof according to IP56, when properly installed. The plug must be fitted with the plastic cap to keep the connector free of dirt and moisture. A separate screw cap for the Display unit comes as part of the installation kit.*

Display Unit Cable			Processing Unit
Cable pairs	**Color code**	**Connector pin**	**Terminal pin**
1st pair	Pink	5	PWR
	Grey	4	GND
2nd pair	Brown	1	Bus–
	White	2	Bus+
3rd pair	Yellow	3	POWC
	Green	6	ALARM



FRONT VIEW

Note! *For installations that require special cable length, contact your Simrad distributor for information.*

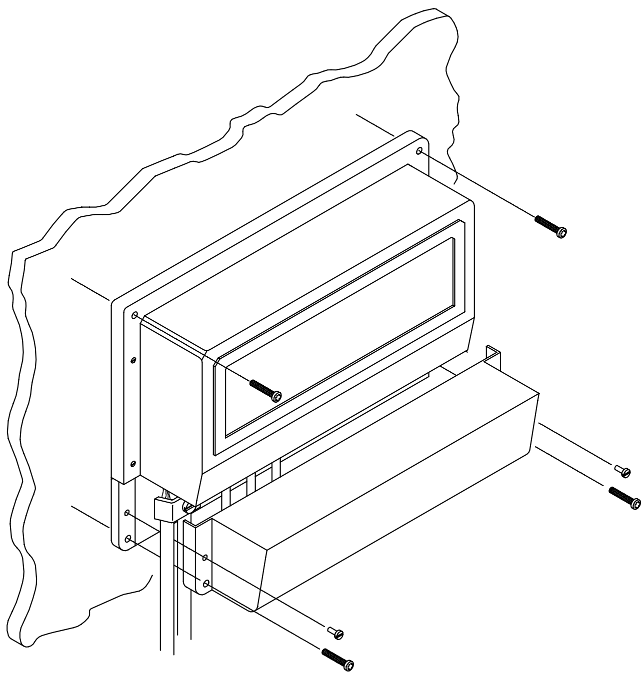
3.6 Processing unit

The Processing unit is not waterproof and should be mounted vertically in a dry place. Reserve sufficient space below the unit to allow insertion for cable connections.

It is recommended that ventilation or air conditioning is provided in order to keep the ambient operating temperature below +55ºC (+130ºF). The best location is typically in the instrument room or on the bridge.

Dimensions for the Processing unit are shown on page 53.

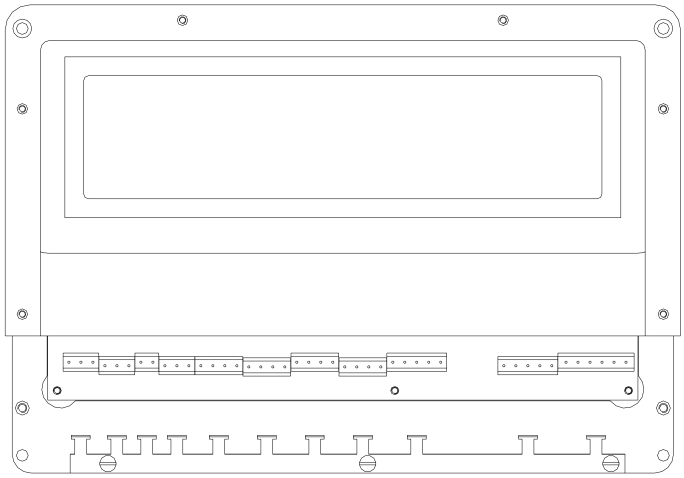
Use the supplied mounting screws for fastening the Processing unit as shown on the figure below.



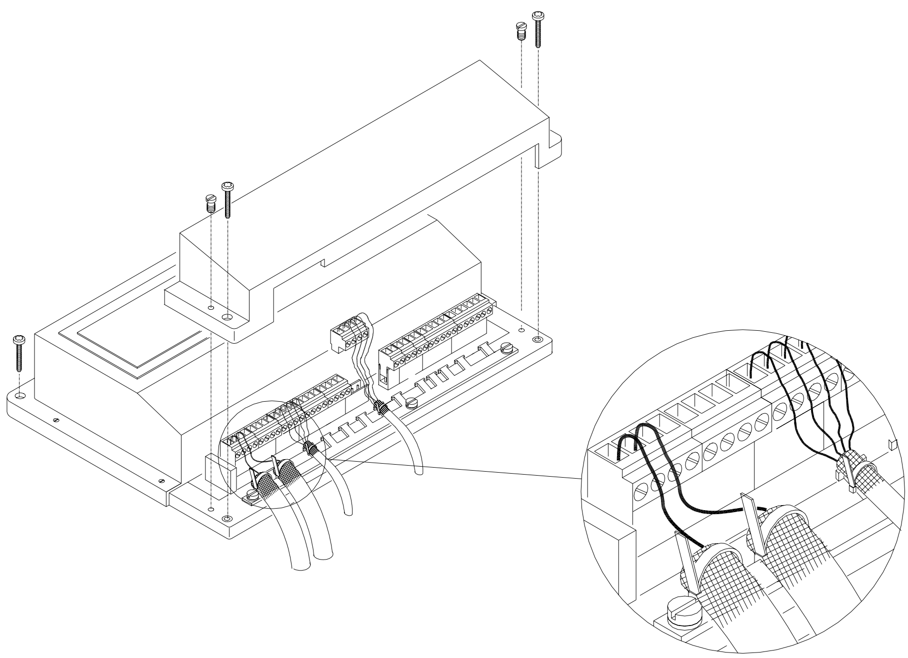
Cable connections

Proceed as follows to connect the cables to the Processing unit:

1 Remove the bottom cover (terminal cover) to get access to the plug-in terminals.



2 Strip 1 cm (0.4") of the cable's insulation and pull the screen backward to cover the insulation. Position the straps as shown in the figure below and tighten well to make sure the screen has good contact.



3 Provide sufficient wire length so that the plug-in terminals can be easily connected/disconnected.

4 Pull out each terminal before connecting the wires. Remove all stands before putting on the terminal cover.

The pinout for each terminal is as follows:

Terminal	Unit	Signal	Colour / Pin
P200	DISPLAY UNIT	ALARM	GREEN
		POWC	YELLOW
		GND	GREY
		PWR	PINK
		BUS+	WHITE
		BUS-	BROWN
P201	SENSOR UNIT	GND	SHIELD
		COMM +	4
		COMM -	3
		PWR+	2
		PWR-	1
J60	Ethernet	RJ45	
P80		NOT USED	
P202	DATA OUT 1	232 OUT	
		422- OUT	
		422+ OUT	
		GND_A	
P203	DATA OUT 1	232 OUT	
		422- OUT	
		422+ OUT	
		GND_B	
P204	DATA OUT 2	232 OUT	
		422- OUT	
		422+ OUT	
		GND_C	
P205	DIFF INPUT	422+ IN	
		422- IN	
P206	DIFF INPUT		
		232 IN	
		GND_D	
P207		NOT USED	
P208	RADAR	AD10_C	
		AD10_D	
		AD10_GND	
P300	POWER	SHIELD	
		PWR_+	
		PWR_GND	

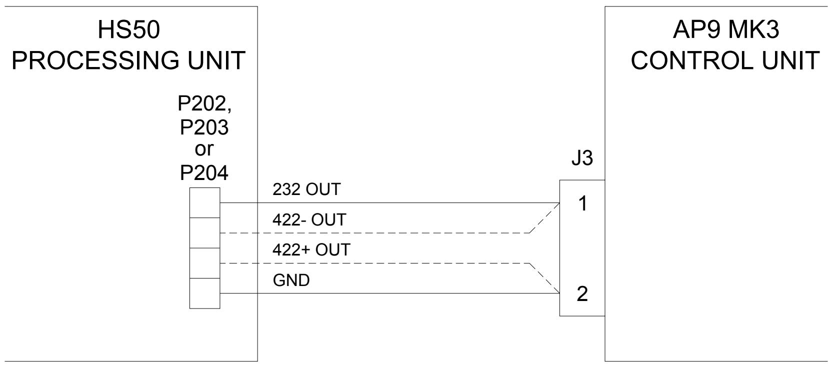
Connecting to Simrad equipment

The figures on the following pages show how HS50 is connected to Simrad equipment.

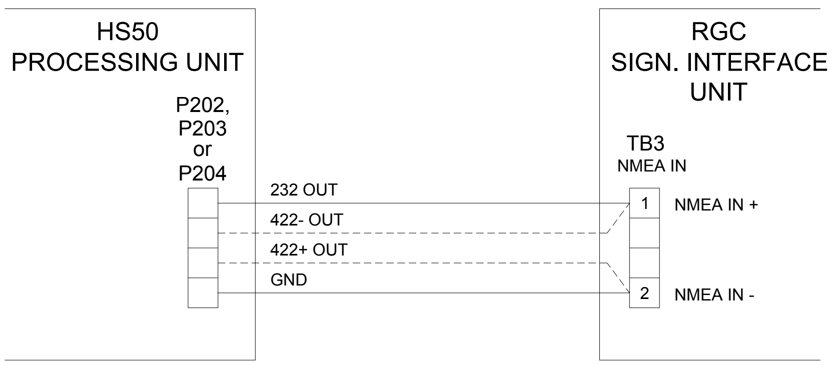
All equipment using NMEA signal is connected to 232 OUT and GND, alternatively to 422– OUT and 422+ OUT on P202, P203 or P204. After the equipment is connected to HS50, the data output line has to be configured as described in ***Data output***, page 27.

Connection to Simrad Radar is done from P208.

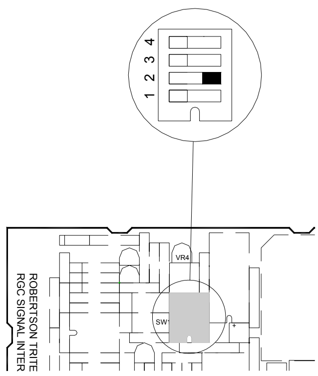
AP9MK3 Autopilot



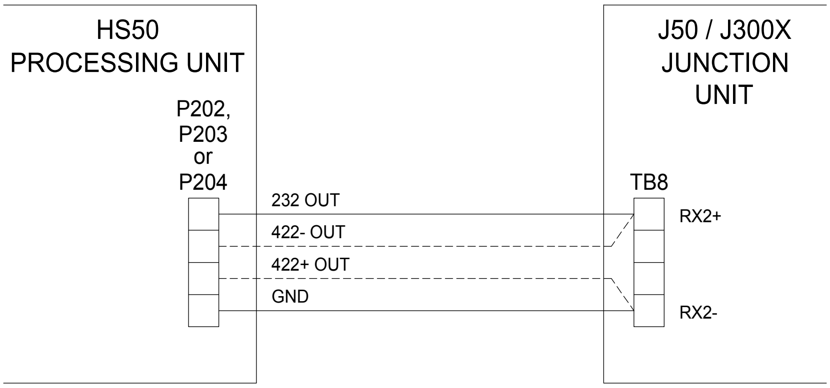
RGC Signal Interface unit



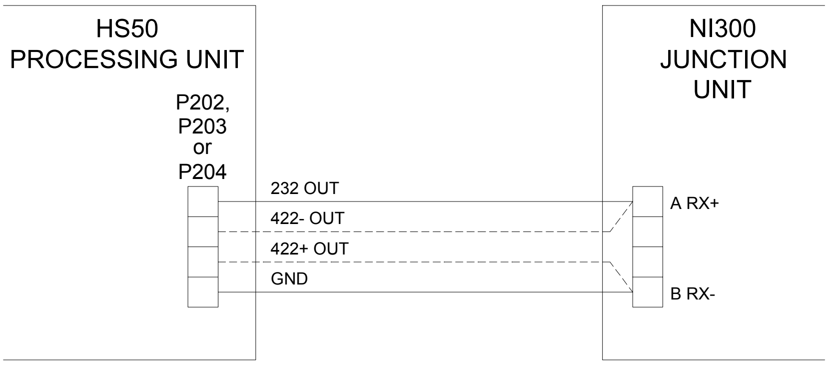
Note! *DIP Switch SW1-2 on the Signal Interface PCB has to be set to NMEA according to the figure.*



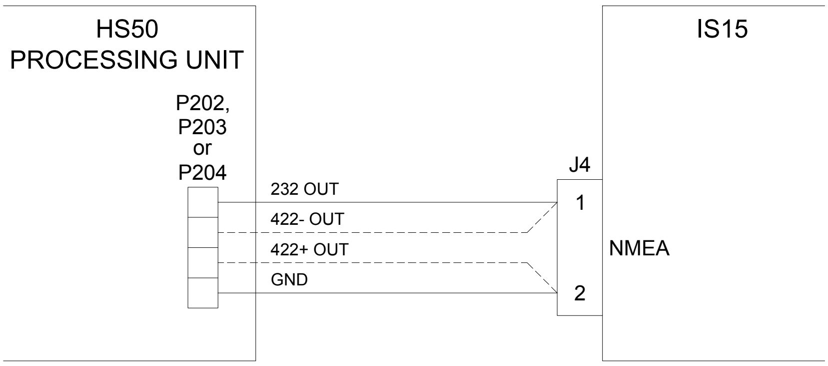
J50/J300X Junction unit



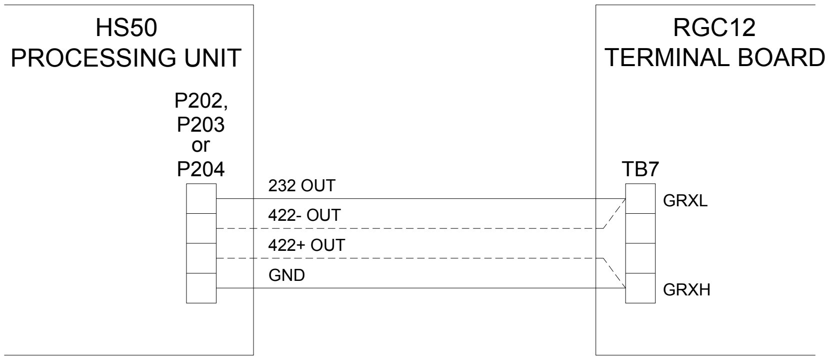
NI300X



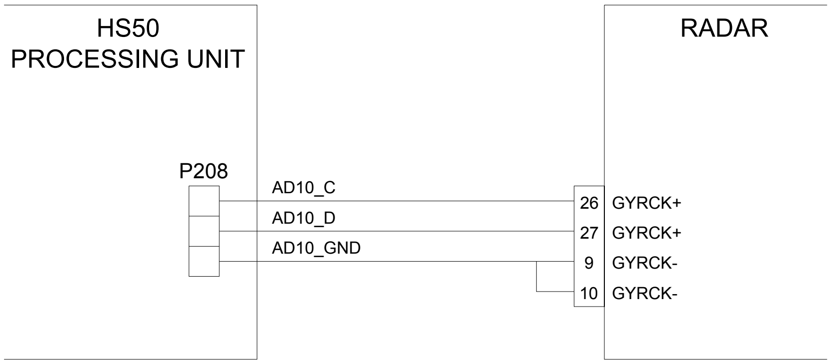
IS15 Instruments



RGC12 Gyro Compass



Simrad RA40/RA50 Radar



Note! *Requires the optional 36-pins connector 72099 for the Radar.*

Software set-up in Radar

1 Go to menu:

MENU → SETUP → CUSTOM → PRESET1

2 Change **Input** from **NMEA** to **10 BIT**

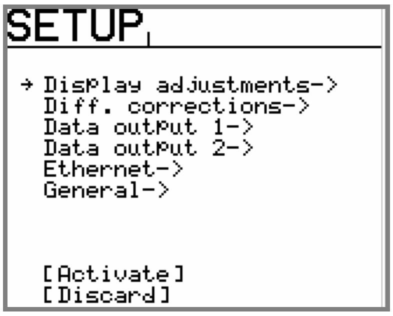
3 Change **Head** from **TRUE** to **MAGNETIC**

3.7 Software setup procedure

This chapter describes a number of installation settings that must be performed as part of the installation of the HS50. Failure to correctly set the values in the installation settings may prohibit the product from functioning properly.

Before attempting to turn on the HS50 and perform an installation setup, the hardware and electrical installation must be completed in accordance with the installation instructions.

The SETUP menu is entered on the Display unit by pressing and holding the **SETUP** button for 5 seconds.



The settings are grouped into the following functional categories:

- Display adjustments
- Diff. corrections
- Data output 1
- Data output 2
- Ethernet
- General
- (Expert Setup, refer page 30)

Use the arrow buttons to select category, and the rotary knob to enter a category's submenu.

The arrow buttons are also used to return from a submenu to the SETUP menu.

Note!

***Activate** and **Discard** selection together with the rotary knob is used to exit the SETUP menu: changes are accepted by using **Activate**, and all changes are erased when selecting **Discard**.*

Example:

The following example shows how to change the **ROT Max** value in the **Display adjustment** submenu using the keys and the rotary knob:

1 Press the **SETUP** key for 5 seconds until the Setup menu appear on the screen.

2 Select **Display adjustment** by turning the knob clockwise

3 Press the arrow down key until the cursor is at the **ROT Max** position

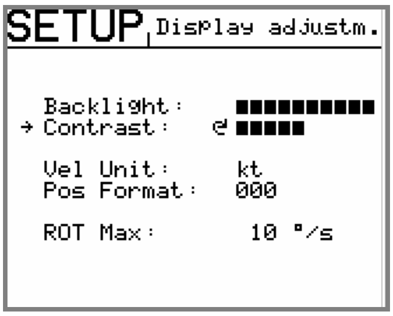
4 Turn the knob to left or right until wanted value appear on the screen

5 Press the **SETUP** key to get back to the main menu

Press the arrow down key until the cursor is at the **Activate** position and then turn the knob clockwise. Then the new setup is activated.

Display Adjustments

In the **Display adjustments** submenu the backlighting and contrast of the display are adjusted. The format for velocity (knots or m/s) and resolution on position displayed may be specified, together with the maximum rate of turn (ROT) value to be shown on the display. Default value for ROT is 20°/s.

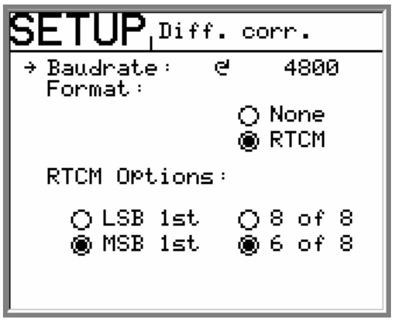


When navigation information (NAV1 or NAV2 menu, refer page 36) are selected, the display backlighting may be increased or decreased by using the rotary knob.

Differential corrections

The signal cable with the differential corrections is connected to the terminal block P205 on the Processing unit for RS-422 input signal, and P206 for RS-232 input signal.

In the **Diff. corrections** submenu the correct baud rate and format for the signal must be set. If **RTCM** format is selected, the correct **RTCM Options** must be selected to enable differential corrections to be used in the position solution.



If data from more than one reference station are available on the link, HS50 automatically uses the nearest reference station to obtain the best solution. The default **RTCM Option** is **MSB 1st** and **6 of 8**.

Data output

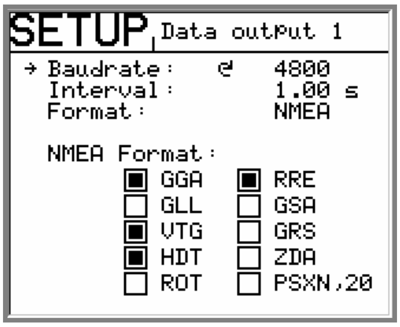
The Processing unit has two individually configurable output serial lines.

On output line **Data output 1** two RS-232 and two 422 serial lines are available. The signal cables can be connected to both terminal block P202 and P203.

On **Data output 2** one RS-232 and one 422 serial lines are available. The signal cables are to be connected to terminal block P204.

Note! *All six serial lines may be used simultaneously!*

The setup of baud rate, interval between NMEA sentences and output formats for each port are performed in the **Data output 1** and **Data output 2** submenu.



Baudrate: The rate at which bits are transmitted. 4800 is standard NMEA rate.

Interval: Interval in seconds between each NMEA sentence.

Example:

Interval setting	Hz
1 sec	1 Hz
0.5 sec	2 Hz
0.2 sec	5 Hz
0.1 sec	10 Hz
0.05 sec	20 Hz

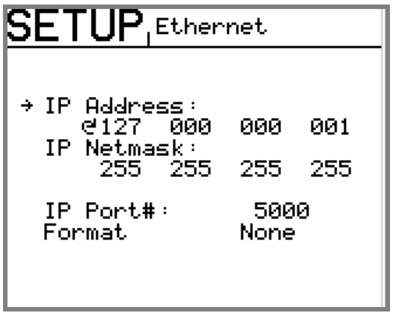
Format: Format on data output line. The following selections are available: **NMEA** and **none**.

NMEA Format: NMEA sentences to be sent to output line.

WARNING! ***If "none" is selected as output format, no data will be sent to output line.***

Ethernet

The Processing unit can output data on Ethernet from terminal J60. In the **Ethernet** submenu the IP address, netmask, IP port number and output format have to be specified. For the NMEA format the messages GGA, GLL, VTG, HDT, ROT and RRE are included.



IP Address: Default setting: 010 000 021 030.

IP Netmast: Default setting: 255 255 255 000.

Format: Format on Ethernet line. The following selections are available: **NMEA** and **None**.

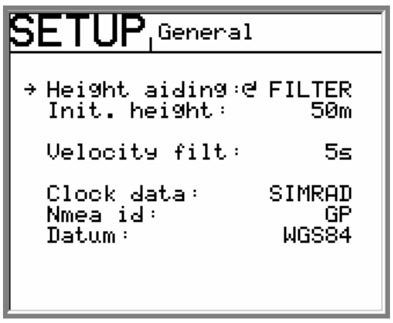
WARNING! ***If "None" is selected as output format, no data will be sent to Ethernet line.***

Caution! ***A change in IP Address and IP Netmask parameter will not take effect before the HS50 is restarted!***

Note! *The cable to be used has to be a crossed Ethernet cable.*

General

The **General** submenu includes selection of height aiding, velocity filtering, Clock data, NMEA id and Datum.



Height aiding

For operations with weak satellite geometry the position output can be made more accurate by using height aiding. For normal operation height aiding should be set to **Filter** or **Off**. When **Filter** or **Fixed** is selected, an initial height has to be entered. The value to be entered in **Init. height** is the GPS height value **HGT** shown in the position display window no. 1, refer page 36, average over some minutes.

Note! *Height aiding is active only with input of differential GPS.*

Velocity filtering

The HS50 output raw data for SOG and COG with the default velocity filter value set to **3 sec**. When smoothing of the SOG and COG measurements are required the filter period could be selected in the range 1 to 99 seconds in steps of one second. With a high filter period more smoothing of the SOG and COG measurements will be achieved and the response to speed and course changes gets slow.

Radar format

On the Processing unit terminal P208 output to radar is available (AD-10 format. The default setting is **OFF**.

NMEA ID

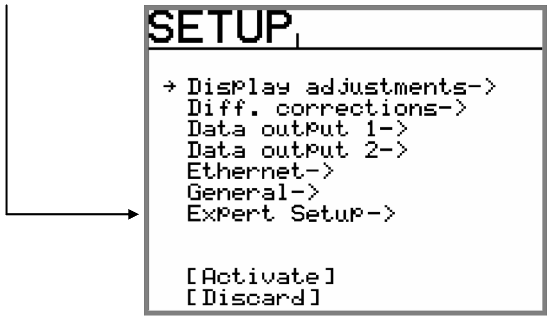
The NMEA ID for the HS50 output lines can be selected between the following IN, HE, HC, GP and TI. The default setting is IN (Inertial Navigation).

Datum

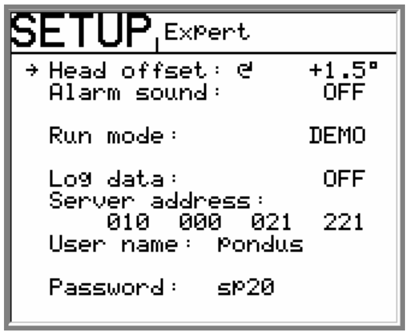
For the position Datum, only the WGS-84 is available.

Expert setup

By pressing the **SETUP** button twice and then holding this button for 5 seconds, an **Expert Setup** category will be available in the **SETUP** menu.



Use the rotary knob to enter the **SETUP Expert** submenu.



The following settings are available:

Head offset: Used for correcting a constant heading offset. Refer Heading offset, page 31.

Alarm sound: Used for turning alarm text and alarm sound on and off. Refer Alarms, page 39.

The following selections are available:

<u>POS-Q</u>

Only invalid position will activate alarm.

<u>HDT-Q</u>

Only invalid heading will activate alarm. HDT-Q is the default setting.

<u>All</u>

Both invalid position and invalid heading will give alarm.

<u>Off</u>

Used for tuning off all alarm text or alarm sound.

Run mode: Used for switching the HS50 between NORMAL and DEMO mode.

DEMO mode is used for simulating input data to the system.

WARNING! ***The HS50 must not be switched to DEMO mode when the system is in operation!***

Log data, Server address, **User name** and **Password**:

Used for service purpose.

Caution! ***A change in Expert setup parameters (except Head offset and Alarm sound) will not take effect before the HS50 is restarted.***

Heading offset

The **Head offset** feature allows you to correct for a constant compass heading offset that may be present as a result of an off axis misalignment between the Sensor unit and the vessel alongships axis.

Note! *It is important that the Sensor unit is mounted accurately in the alongships direction so the **Head offset** value does not exceed ±5°. If the mounting orientation is not within these tolerances the heading accuracy will be degraded. Instead of exceeding a Head offset value of ±5° the Sensor unit orientation should be adjusted mechanically.*

The system has to be calibrated on board the vessel after installation. A typical calibration consists of calibrating the direction of GPS antennas within the Sensor unit against an external reference. Type of reference must be decided according to the required accuracy. Alternative references for calibrating the heading offset of the Sensor unit could be:

- The heading of the pier or quay the vessel is moored to.
- An external compass reading like from a gyro compass.
- Two fixed points on the chart that the vessel is sailing between.

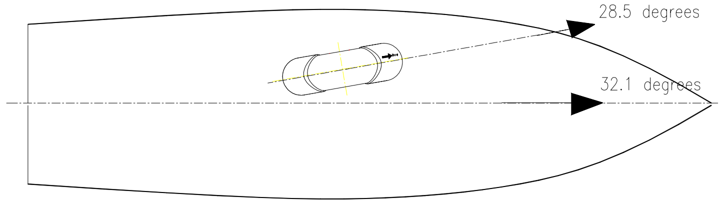
The observation period for the heading difference should continue for an as long as possible period in order to eliminate errors in the HS50 measurements caused by multipath effects. These may be particularly pronounced in the static conditions of a harbor area.

The average value for observations from each of the two different systems should then be used, and the offset between the two systems (reference value minus HS50 reading) input as the **Head offset** value.

The offset value can be either positive or negative.

Example:

If the heading measured by the reference system is 32.1° and the HS50 heading 28.5° during the calibration period, **3.6** (32.1 - 28.5) should be entered in the **General** submenu as the **Head offset** value.

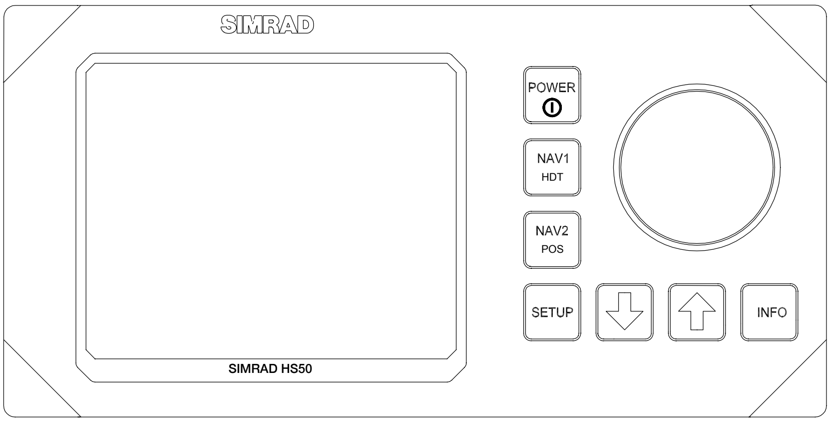


4. OPERATING INSTRUCTIONS

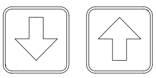
4.1 Overview

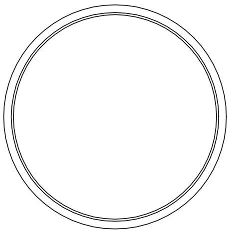
The Display unit is used for setup and operation of the HS50. Each of the push buttons is clearly identified with the primary function in large text, and a secondary function listed in smaller text. Each button provides you with the ability to access a primary display, a secondary display and/or multiple function displays.

Adjustable settings are provided in the SETUP mode. The settings allow adjustment of mounting orientation, selection of differential correction, setup of output serial line formats, Ethernet and the display. Refer ***Software setup procedure***, page 21.



The Display unit consists of the main elements as listed below.

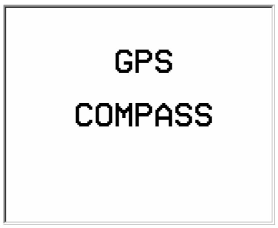
	FUNCTION	REF. PAGE
POWER	Power on/off.	34
NAV1 HDT	Displays Navigation/HDT display with compass rose or details.	36
NAV2 POS	Displays Navigation/POS with position and accuracy ellipse.	36
SETUP	Displays SETUP menu.	21
	Used for maneuvering in the SETUP submenus.	21
INFO	Used for displaying additional system information.	37

	FUNCTION	REF. PAGE
	The rotary knob is used for entering values in SETUP submenus, and for adjusting the display brightness.	21

4.2 Turning the system ON/OFF



A single press on the **POWER** button switches the system ON, and the following start up information is shown on the display:



Once installed, calibrated and started, the HS50 needs no manual intervention during operation.

After power on, up to 15 minutes is needed to obtain full accuracy on all data. Since there normally is no reason for turning the unit off, it should be left running continuously.

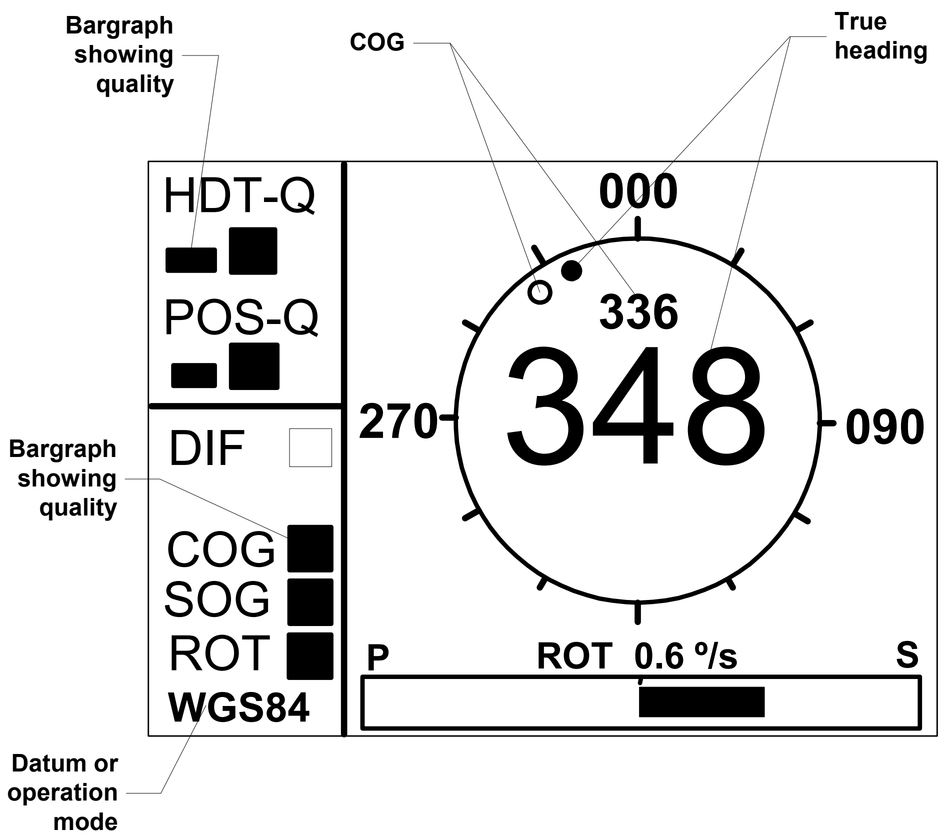
The HS50 will be shut down in a controlled way when the **POWER** button is pressed for 1-2 seconds. Then the message ***Shutdown in process*** will appear on the screen. If the **POWER** button is pressed and held for 5 seconds or more, the system is shut down immediately. Typically used if the system has a hang-up and does not respond on any commands. The configuration of HS50 is however stored on the internal flash disk independent on how the unit is powered off.

4.3 Performance monitoring

The navigation display NAV1 and NAV2 includes on the left side of the screen data quality and status information. The indicators are as follows:

- **HDT-Q**. The quality of the heading measurements. Two black bar graphs indicate normal accuracy, one black and one white bar graph indicate reduced accuracy and two white invalid heading.

- **POS-Q**. The quality of the position measurements. Two black bar graphs indicate normal accuracy, one black and one white bar graph indicate reduced accuracy and two white invalid position.
- **DIF**. Indicated whether differential corrections are input and used in the position determination or not. A black box indicates that differential corrections are used. A white box indicates no use of differential corrections.
- **COG**. A black box indicates valid COG calculation, a white an invalid calculation.
- **SOG**. A black box indicates valid SOG calculation, a white an invalid calculation.
- **ROT**. A black box indicates valid ROT calculation, a white an invalid calculation.
- **WGS84**. Shows the Datum used for the position and velocity determination. If the text **DEMO** appears in this field the system is operating in demonstration mode with simulated output data.



An invalid HDT-Q status indication will be shown after 300 seconds of loss of GPS heading in the system, and the output of heading data will terminate. In the first 300 seconds after loss of

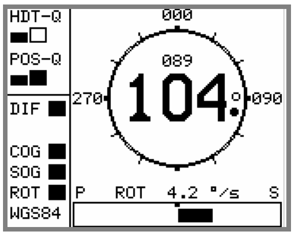
GPS heading, the heading output is determined from the inertial element.

The data quality status information indicated on the Display unit is also included in some of the NMEA messages that can be output on the serial lines.

Navigation/HDT display

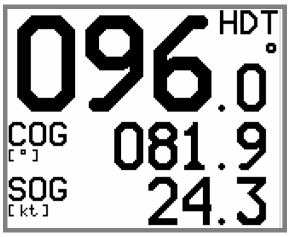


When pressing the **NAV1/HDT** button, the HS50 will toggle between two different displays for heading information.



Primary NAV1/HDT display, shown after the start-up screen when the HS50 is turned ON.

True heading is shown as a big number in the center of the compass with the COG value above it.



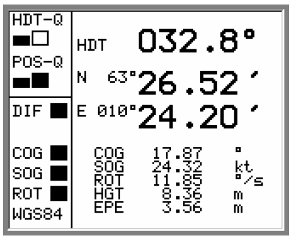
Secondary NAV1/HDT display.

This display shows heading, course over ground and speed over ground values in big characters.

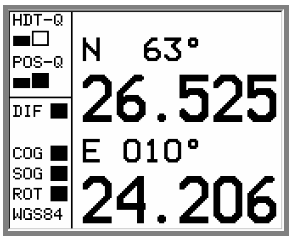
Navigation/POS display



The HS50 will toggle between three different displays for position information when the **NAV2/POS** button is pressed.

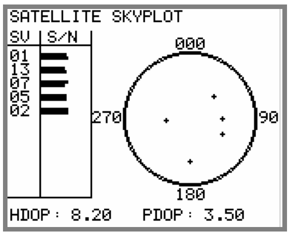


Primary display shown when the **NAV2/POS** button is pressed once. The display shows main navigation information.



Secondary NAV2/POS display.

The display presents position information in large numbers.



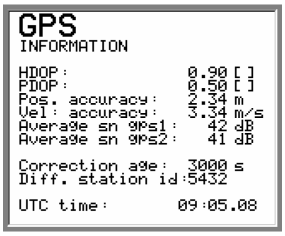
Third NAV2/POS display: the Satellite skyplot.

This display shows satellites in sight by the Sensor unit, and which satellites the HS50 is tracking. The satellites are presented according to satellite geometry. The bars on the left side of this display indicate the signal-to-noise level for each satellite.

Info displays



When pressing the **INFO** button, the system will page through a number of displays for information about system configuration and performance. The information on some of these displays is mainly used for troubleshooting the system.



In the GPS information display details for the position solution is presented. This information is mainly for trouble shooting of the system.

An explanation of the information shown is as follows:

HDOP
PDOP Quality indicators for the GPS solution.

Pos. accuracy Estimated accuracy on the position solution (RMS).

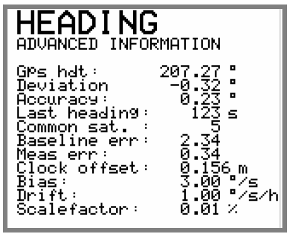
Vel. Accuracy Estimated RMS accuracy on the velocity solution (RMS).

Average sn gps1
Average sn gps2 Average signal-to-noise ratio on the GPS receiver 1 and 2.

Correction age Age of differential corrections. If HS50 receives no differential correction, the displayed correction age will be high. See ***No Differential corrections***, page 47 for trouble shooting loss of differential signal.

Diff. Station id Actual reference station utilized in the position solution.

UTC time World time referred to UTC.



In this display, a number of additional information on the heading solution is presented. This information is mainly used for troubleshooting the system.

An explanation of the information shown is as follows:

Gps hdt The heading determined from GPS alone.

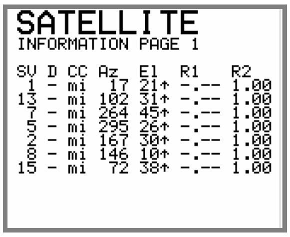
Deviation The difference in heading determined from GPS and the internal gyro element.

Accuracy The instantaneous heading accuracy determined from GPS alone. The instantaneous accuracy might differ from the specified accuracy which is a figure determined for the combination of GPS heading and heading from the internal data element. The specified accuracy figure for the product is also calculated as a standard deviation over a number of samples. The figure shown as Accuracy might occasionally be higher than the specified heading accuracy. If the Accuracy figure shown is much higher (3 times or more) than the specified accuracy, then the performance of the system is poor. Check ***Reduced heading indication***, page 48 in this manual for troubleshooting the system.

Last heading This is the time since the system calculated the GPS heading. If GPS signals drops out this figure will increase. In the first 300 seconds after loss of GPS heading, the heading output is determined from the inertial element. After 300 seconds of loss of GPS heading in the system the output of heading data will terminate. If so, see ***Invalid Heading***, page 47 for trouble shooting the system.

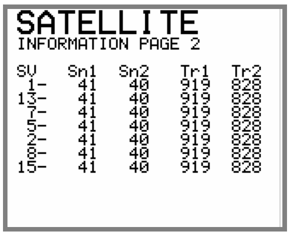
Common sat. Shows the number of common satellites seen by the two GPS antennas. The number of common satellites have to be two or higher to determine heading. If the number is less than two, see ***Invalid Heading***, page 47 for trouble shooting the system.

The other information in this display is only of interest to service personnel.



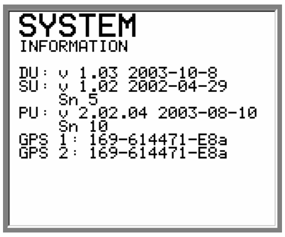
Number of satellites used in the GPS position fix with indication of increasing or decreasing azimuth (Az) and elevation (El).

This display is mainly used by service personnel.

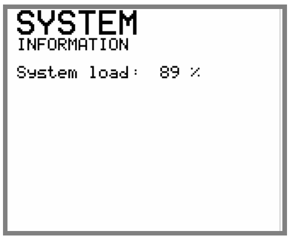


Number of satellites used in the GPS position solution and the number of satellites tracked by GPS antenna no. 1 (Tr1) and 2 (Tr2).

This display is mainly used by service personnel.



Software version for each unit (Distribution Unit = DU, Sensor Unit = SU and Processing Unit = PU), together with internal serial number for Sensor and Processing unit. The date behind each unit's software version refers to manufacture date for the unit.



System load as percentage of used CPU capacity.

4.4 Alarms

The HS50 will generate an acoustic alarm and an alarm text if heading or position information is invalid or missing.

The acoustic alarm will sound for 5 seconds, and the alarm text will remain in the display until the **NAV1** or **NAV2** button is pressed. No data will be output from HS50 as long as the alarm situation is present.

If the **SETUP** menu is active when the alarm condition arises, the alarm text will be displayed when the **SETUP** menu is left.

Note! *No alarm will be activated if the system is setup to not respond to alarm situations. Refer* ***Expert setup****,* *page 30.*

Invalid Position alarm

Activated if the system has been unable to determine position the last two seconds, or if the HDOP value is greater than 4.

See ***No valid data*****,** page 46 for troubleshooting.

The following alarm text will be displayed:

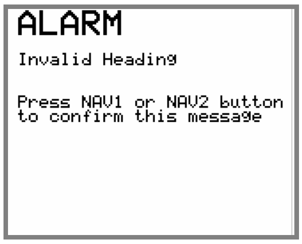


Invalid Heading alarm

Activated 300 seconds after the system is unable to determine GPS heading and the HDT-Q indication has become invalid.

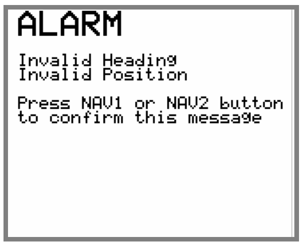
Invalid Heading, page 47 for troubleshooting.

The following alarm text will be displayed:



Invalid Position and Heading alarm

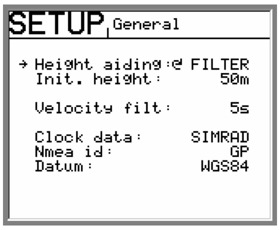
If both heading and position data is invalid, the display will show:



4.5 Operation

The HS50 will normally output signals on the serial lines without any involvement from the user. However, the following should be taken into consideration during operation:

Height aided GPS position



In periods with weak satellite geometry, the position can be made more accurate by using height aiding function in the **General** submenu. Refer ***General***, page 28.

The height aiding improves the solution by using the knowledge that a vessel at sea has only small short-term variations in height caused by heave. The long-term variations caused by tide are taken care of in the system. The height value used, as input to the GPS solution is a low-pass filtered value of the measured height.

A start value for the low-pass filter should be specified for use at system start-up. The value to use is the height of the Sensor unit above the WGS-84 ellipsoid when the sea level is at its mean value. This height can be found in the primary **Navigation/POS** display, where the **HGT** value is the GPS height. Refer ***Navigation/POS display***, page 36. The value should be monitored for some minutes, and the average value should be used.

Note! *The height difference between mean sea level and the WGS-84 ellipsoid can be significant. Values between +/- 100 meters can be encountered.*

For normal operation, height aiding should be set to **FILTER** or **OFF**. When **FILTER** or **FIXED** is selected, an initial height has to be entered.

Height aiding is active only with input of differential GPS.

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5. MAINTENANCE

5.1 General

Service on the HS50 hardware in the field can consist of:

- Replacing damaged cables
- Replacing failed Sensor unit
- Replacing failed Processing unit
- Replacing failed Display unit

The Sensor unit is not designed for service in the field and opening the housing will result in damage or degradation of the unit and void the warranty. A failed Sensor unit has to be shipped back to Simrad in the original transportation box or another appropriate box for service. The return address is provided in the last pages of this manual.

The software in HS50 can be upgraded to latest version in the field by connecting an external PC to the Processing unit. A software upgrade has to be performed by Simrad service people or representatives.

5.2 Periodic maintenance

The user should execute all necessary maintenance. This includes normal cleaning of all units and inspection of cables and connectors at intervals. Components which malfunction should either be replaced or sent back to Simrad for service.

The periodic maintenance of the HS50 components is as follows:

Sensor unit

Make a visual inspection at 2-3 months intervals, and at the start of each season.

Re-calibration of the Sensor unit

The direction of the Sensor unit relative to the vessel's heading has to be recalculated only if the Sensor unit has been moved or dismounted from its holder. Then the calibration procedure described in ***General*** section**,** page 28 has to be followed for re-calibration of the heading.

Processing unit

No special maintenance is required. It is advisable, however, at the start of each season to make a visual inspection of the terminals below the bottom cover (terminal cover) and check all connections.

Display unit

The Display unit will under normal use require little maintenance.

If the unit requires any form of cleaning, use fresh water and a mild soap solution (not a detergent). It is important to avoid using chemical cleaners and hydrocarbons such as diesel, petrol etc.

Make sure that all open connectors on the Display unit are fitted with a protection cap.

It is advisable at the start of each season to check all connections to the unit and cover with Vaseline or WD40. If the Display unit is not removed from the vessel, it should be covered with the white protection cover.

Software upgrades

Software upgrades with improvements and new functionality will regularly be offered. Download of new software version is performed from an external PC by utilizing the Ethernet port on the PC and the HS50 Processing unit. Some new software releases will also require a new PROMM installed in the Display unit.

5.3 Repairs and modifications

Repair of the HS50 units is limited to replacement of damaged cables, Sensor unit, Processing unit, or Display unit.

Replacing damaged cables

Power off the Processing unit and dismount the damaged cable. If the connector is not damaged it may be re-used, else a new connector has to be made available.

Assemble the connector to the new cable as described in the wiring information for the damaged cable. Refer the ***INSTALLATION*** section, page 9 onwards.

Terminate the cable to the Processing unit as described in ***Cable connections***, page 19.

Replacing damaged units

No HS50 units are designed for service in the field, and a damaged unit has to be shipped back to Simrad for repair.

Caution! ***Opening the Sensor unit housing may result in permanent damage to the unit!***

Install the new unit according to procedures described in the ***INSTALLATION*** section, page 9 onwards.

5.4 Troubleshooting

A GPS compass is a complex system and performance is dependent of a proper installation and a successful sea trial.

In case of a failure, the user will be helped by the Display unit, which contains several test features that will assist you in isolating a probable fault.

Pressing any button resets the audible alarm. The visual alarm will remain and alternate with the operating display until the fault has been rectified. Refer to the table below for hints and try to solve the problem yourself, or consult your nearest Simrad dealer for assistance.

The next sections contain some hints for troubleshooting.

No response

In normal operation it takes about one minute from the Display unit is powered on until information appears in the display. If the display screen is still black after three minutes from power on, do as follows:

- Check the power connection to the Processing unit, and check that the Processing unit is supplied with correct voltage. Refer specification in ***Power*** section, page 7.
- Press the **POWER** button on the Display unit two or three times in case of poor connection.

If there are still no information on the display, consult your nearest Simrad dealer for assistance.

No valid data

In normal operation it can take up to 15 minutes from the Display unit is powered on to full accuracy on all data is obtained, and the indicators showing valid data. If all the indicator boxes are still white after 15 minutes from power on, then do as follows:

- Check that connectors are properly connected to Display unit and Sensor unit.
- Check that cables from Sensor unit and Display unit are correctly terminated to the Processing unit according to the pin-out shown on page 20.
- Check that the cables are correctly terminated in the connectors. Refer ***Cable wiring***, page 13 for the Sensor unit, and ***Display unit cable*** page 17 for the Display unit. If not, switch off the power, re-connect the cable to the connectors properly, and power on the unit again.
- If all connections are correct and still no valid data, the mounting location of the Sensor unit may not be suitable, less than four satellites are in view, or there may be an obstruction between the Sensor unit and the GPS satellites. Check the mounting location and consider relocation according to ***Location of the unit***, page 10.

If there are still no valid data, consult your nearest Simrad dealer for assistance.

No Differential corrections

The possible reason for a white box for differential correction indication (DIF) could be one of the following:

- No differential corrections are input through terminal port P205 or P206 on the Processing unit. If differential corrections are input through one of these terminal ports, check that the parameters are properly set up in the Display unit setup menu **Diff. input**, see ***Differential corrections***, page 26.
- You can be out of range to a radio reference station and the differential corrections are therefore missing. If the reference station is too far away or it is in the shadow of geographical obstructions or other equipment on board, reception may be unreliable or missing. Pressing the **INFO** button and the display GPS Information shows the identification number of the reference stations connected to the HS50.
- The reference station can be out of function. Check the status of the reference station with the authorities responsible for it, or consult your nearest Simrad dealer for assistance.

Invalid Heading

The possible problem can be one of the following:

- The number of GPS satellites the Sensor unit is able to see is too few. Press the **NAV2/POS** button until the Skyplot view appears. Check that at least four satellites are available and that the PDOP value is less than 6. Refer Satellite Skyplot display, page 37. Check also the number of common satellites seen by the two GPS antennas by pressing the **INFO** button and looking at the value for **Common sat.** in the advanced heading information display as shown in page 38. The number of common satellites have to be two or higher to determine a heading.

If one of the criteria's above is not fulfilled, the mounting location of the Sensor unit may not be suitable or there may be an obstruction between the Sensor unit and the GPS satellites. Check the mounting location and consider relocation according to ***Location of the unit***, page 10.

If it is still not working after checking the above items, consult your nearest Simrad dealer for assistance.

Reduced heading indication

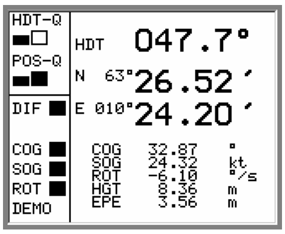
The reason for reduced heading performance could be one of the following:

- The number of GPS satellites the Sensor unit is able to see is too few. Press the **NAV2/POS** button until the Skyplot view appears. Check that at least four satellites are available and that the PDOP value is less than 6. Refer Satellite Skyplot display, page 37.
- Check also the number of common satellites seen by the two GPS antennas by pressing the **INFO** button and looking at the value for **Common sat.** in the advanced heading information display as shown in page 38. The number of common satellites have to be two or higher to determine a heading.

If one of the criteria's above not is fulfilled, it may be an obstruction between the Sensor unit and the GPS satellites. Consider moving the vessel to another location to see whether that helps.

If it is still reduced after checking the above items, consult your nearest Simrad dealer for assistance.

Simulated data



If the HS50 system is not sending out real data, check whether the system is operation in demonstration mode with only simulated output data. If the system operates in demonstration mode the text **DEMO** appear at the bottom of the status field as shown in the figure.

Refer ***Expert setup***, page 30.

6. FIGURES AND DRAWINGS

This section contains outline drawings showing the mechanical dimensions of the different HS50 parts. To scale drawings are available upon request.

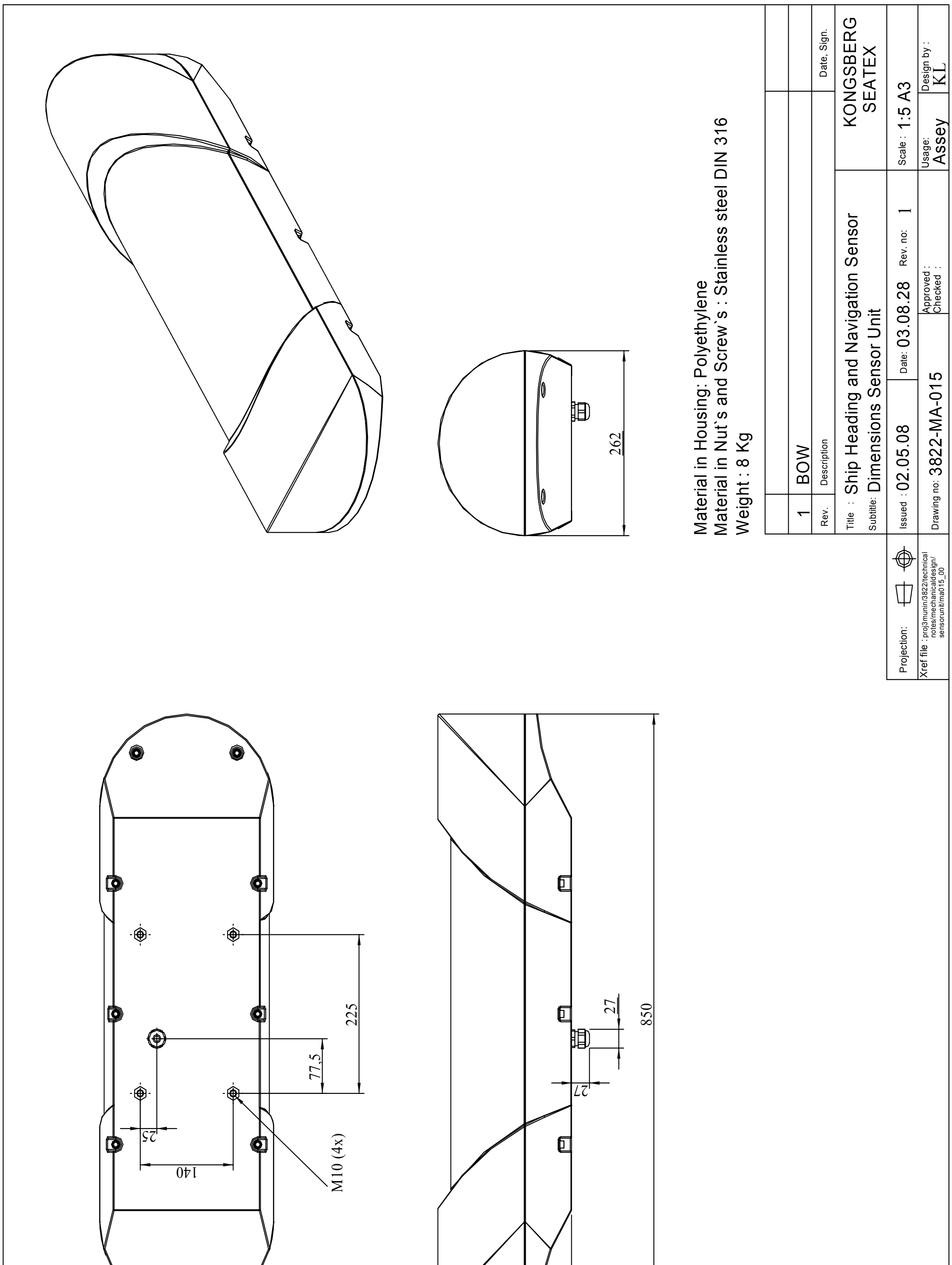
The following drawings are enclosed:

Name	Drw. no	Rev.
Sensor Unit, dimensions	3822-MA-015	1
Sensor Unit Bracket, dimensions	3822-MD-027	2
Sensor Unit Pedestal, dimensions	3822-MD-034	0

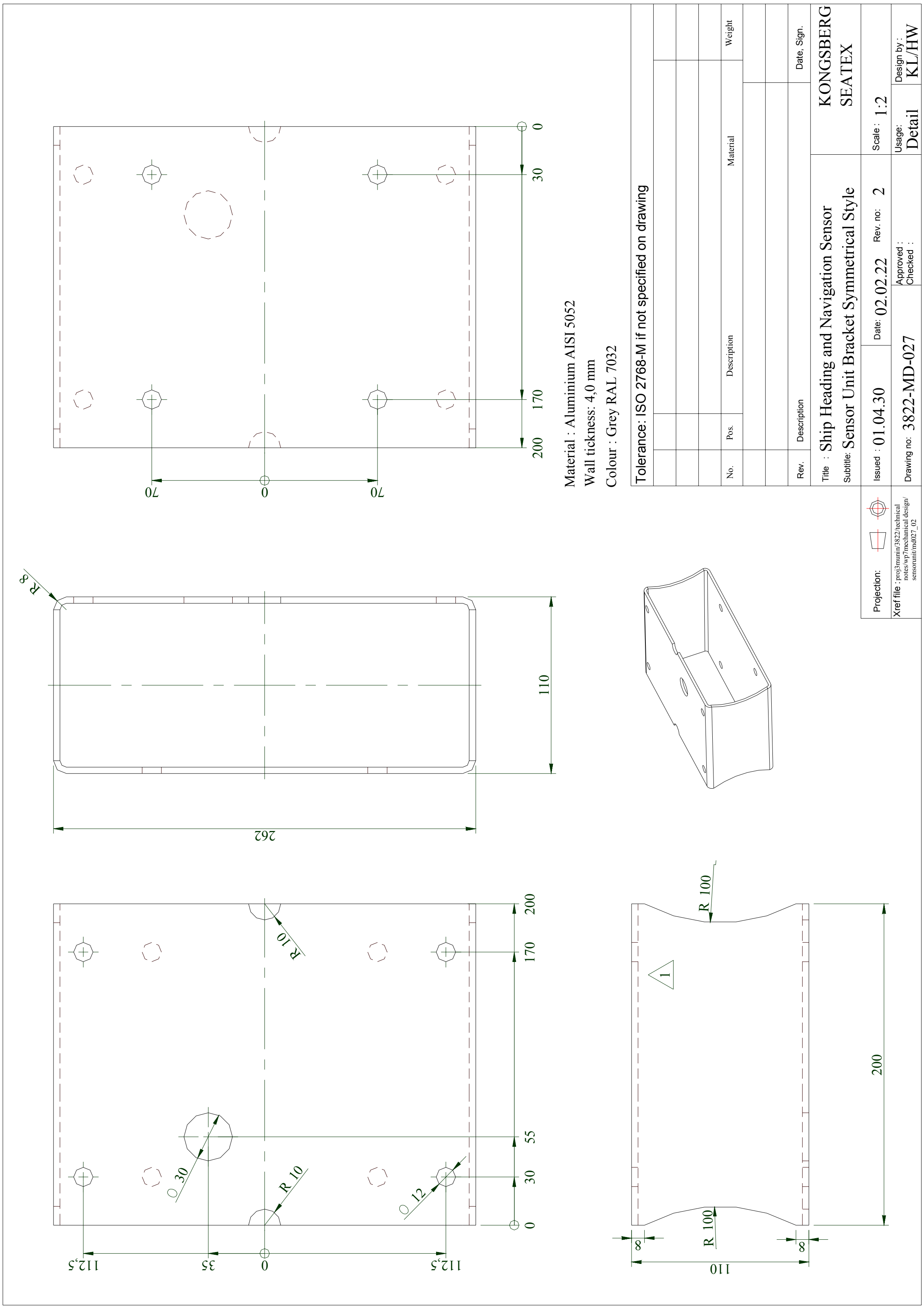
The following figures are enclosed:

Name	Page
Processing Unit, dimensions	53
Display Unit, dimensions	54

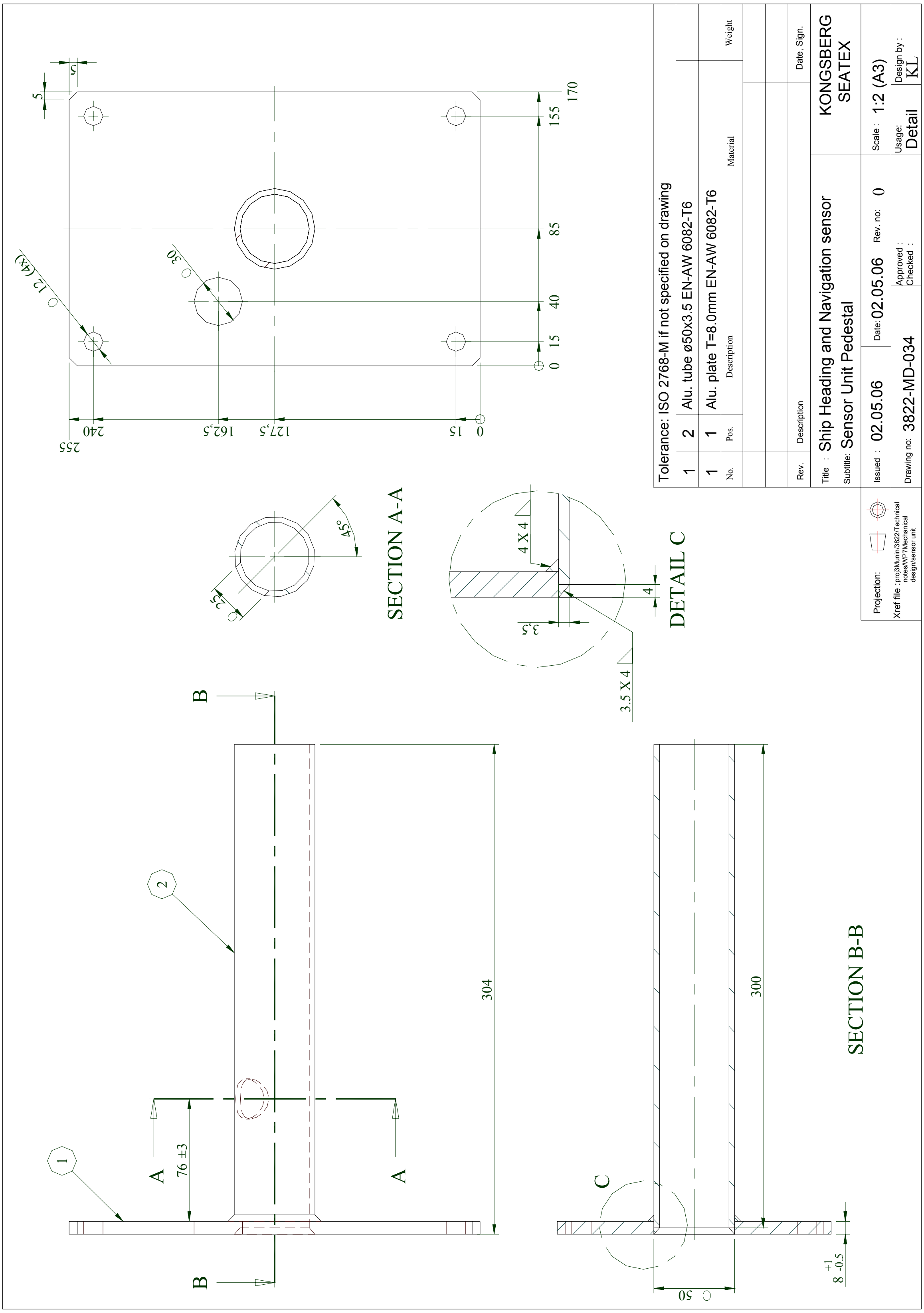
6.1 Sensor unit, dimensions



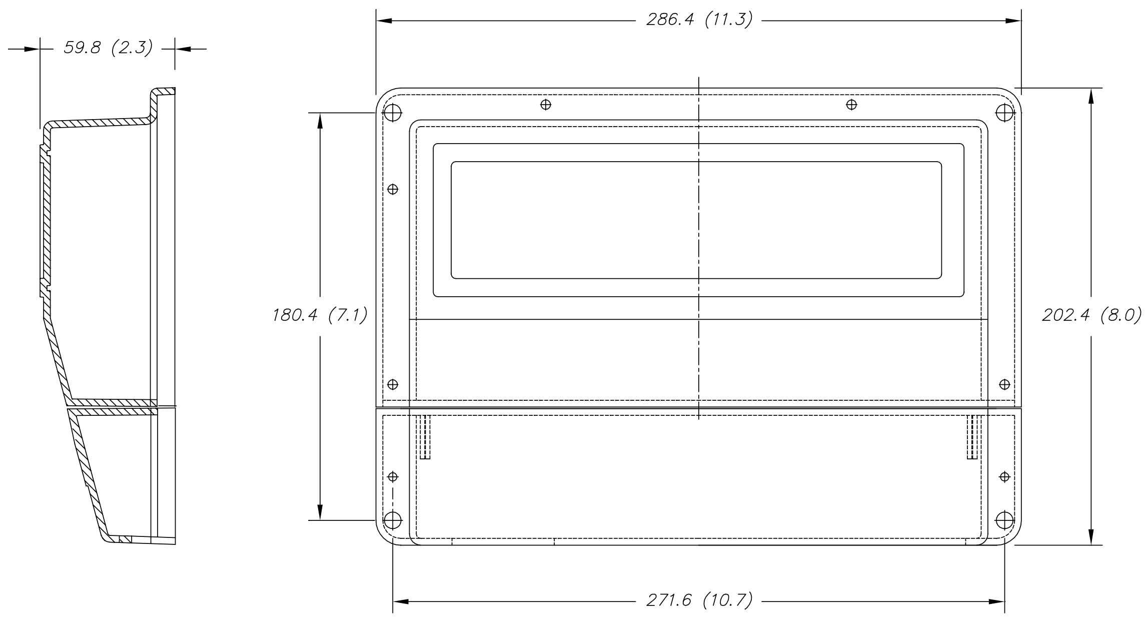
6.2 Sensor unit bracket, dimensions



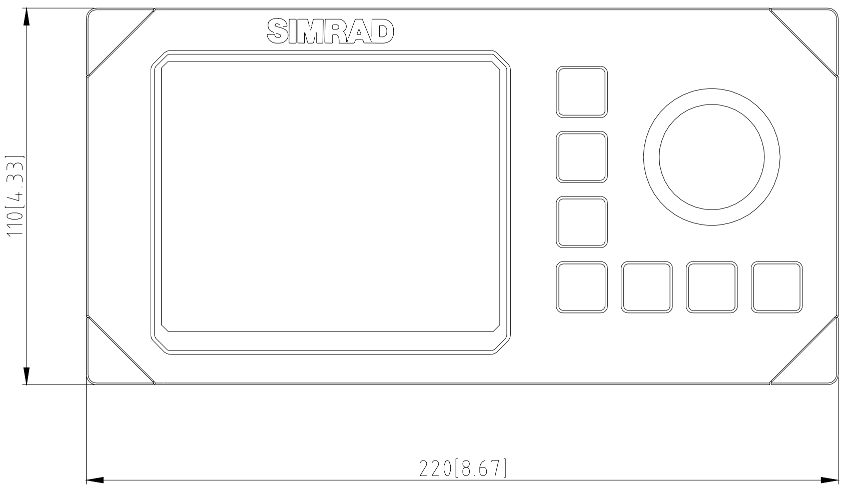
6.3 Sensor unit pedestal, dimensions

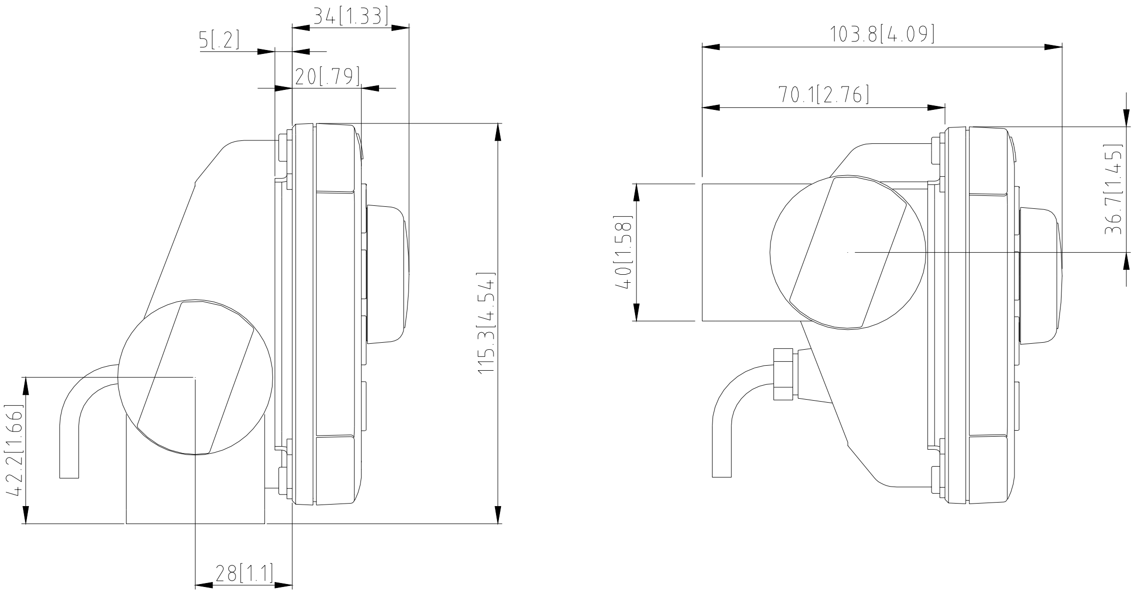


6.4 Processing unit, dimensions



6.5 Display unit, dimensions





Note! *Mounting bracket is optional*

7. PARTS LIST

7.1 Standard delivery

The standard HS50 consists of:

Part no.	No.	Description
20212858	1	HS50 Sensor unit, including 1 meter cable and 4 fastening bolts
22084289	1	HS50 Processing unit including 4 fastening screws
20212759	1	HS50 Display unit, including 15 meter cable, flush mounting kit and protecting cover
20212940	1	30 meter cable
20213054	1	HS50 Standard English documentation, including cut-out templates and Quick Reference guide.

7.2 Optional equipment

The HS50 can be delivered with following optional equipment:

Part no.	Description
20213039	HS50 Sensor Unit Mounting Bracket
20213021	HS50 Sensor Unit Mounting Pedestal
22084941	Mounting bracket for Display unit

7.3 Documentation

The HS50 system includes English documentation only, and national documentation has to be ordered separately.

All national documentation includes a Quick Reference Guide.

The following documentation can be delivered:

Part no.	Description
20213245	HS50 Documentation, Swedish
20213252	HS50 Documentation, Spanish
20213609	HS50 Documentation, Italian